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(54) Food container for vacuum lidding.

(57) A container is disclosed, which is made of a substantially gas impermeable material, said container comprising a floor, a circumferential wall attached to said floor, and a rim distal to the floor, wherein at least the rim and the wall have a plurality of deep, narrow grooves therein which extend from the rim towards the floor on the inside of the container. The container is useful for packaging foods, particularly frozen of refrigerated foods. A method for packaging food is also disclosed which comprises the steps of:

a) placing food in the container

b) positioning a theroformable film above the rim of the container, said film having sufficient melt strength to be conformable to the inside of the container and food;

c) heating said film;

d) lowering said film onto said container while providing a vacuum beneath said container such that the vacuum pulls said film into conformity with the food, the inside walls of the container, the rim and a portion of the outside walls of the container;

e) permitting the film to cool; and

f) removing the lidded container.

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Description

FOOD CONTAINER FOR VACUUM LIDDING

The present invention relates to a container suitable for packaging foods therein and a process for covering such container with a film so that the film conforms to the contour of food which is packaged in the container.

It is known that food may be cooked in conventional ovens when placed in heat-resistant glass, enamelled metal, or aluminium trays or pans. For retention of moisture in the food when cooking, placement of a lid or aluminium foil over the tray or pan is desirable. It is known to prepackage food in aluminium trays with aluminium foil lids for conventional cooking of foods. Aluminium containers are unsuitable for cooking of foods in microwave ovens and, for prepackaged foods, glass containers are too heavy and expensive. Many plastics are excellent materials for microwave applications and it has become widespread to use thermoformed crystalline polyethylene terephthalate (CPET) both for the tray or pan, and the lids. CPET may also be used for containers for cooking foods in conventional ovens. Thus, CPET is often viewed as being suitable for the manufacture of "dual-ovenable" containers, viz, suitable for use in both conventional oven and microwave oven applications. Thermoformed lids tend to be expensive to manufacture, partly because of the thickness of sheet used to manufacture such lids and the quantity of waste formed in the thermoforming process.

Lids are an important component in food packages for the prepackaged food market, and have several functions. Rigid lids are useful for enabling food trays to be stacked, whether in card boxes or not. If sealed to the tray, lids may be used for form, with the tray, a hermetically sealed package. With aluminium or nylon trays, it is often necessary to use thermoformed lids with a snap-fit or to use a foil lid crimped to the tray, because it is not easy to seal materials thereto. Another type of lid may have a vacuum-induced and thermally-set crimp as disclosed in European Patent Publication No. 0282277 to Du Pont Canada Inc., published 1988 September 14. It is particularly desirable for lids to conform to the contours of the food in the container in order to minimize the air space between the food and the lid. Such air spaces contribute to the phenomenon known as freezer burn, which occurs when frozen food is stored for a substantial period in a freezer. The present invention attempts to provide a solution to the problem of freezer burn.

Accordingly, the present invention provides a container made of a substantially gas impermeable material, said container comprising a floor, a circumferential wall attached to said floor, and a rim distal to the floor, wherein at least the rim and the wall have a plurality of grooves therein which extend from the rim towards the floor on the inside of the container.

In one embodiment the grooves, at least at the rim and adjacent thereto, have a width of from 0.25 mm to about 1.5 mm and a depth of from about 0.25 mm.

In another embodiment the depth of the grooves is from 0.3 mm to about 0.5 mm, especially from 0.35 mm to 0.4 mm.

In a further embodiment the width of the grooves is from about 0.7 mm to 1.0 mm.

In a preferred embodiment each groove is 30 mm or less apart from an adjacent groove, preferably 6 mm or less apart from an adjacent groove, and especially 3 mm apart or less.

In another embodiment the rim is in the form of a lip, circumferentially attached to the wall and which extends outwardly from and parallel to the floor.

In a further embodiment the grooves extend to the outside of the container, at least part-way down the outside of the wall.

In yet another embodiment the grooves extend to the outside of the container, at least part-way down the outside of the wall and such exterior grooves are offset from the grooves on the inside of the container.

In yet another embodiment the grooves on the inside of the container are in the form of letters or other design elements.

In another embodiment the lips of at least some of the grooves are raised above the surface of the surrounding container material.

In yet another embodiment the container is injection moulded, preferably from Nylon or polypropylene.

In a further embodiment the container is made from a thermosetting resin.

The present invention also provides a method for packaging food, comprising the steps of:

a) placing food in a container made of a substantially gas impermeable material, said container comprising a floor, a circumferential wall attached to said floor, and a rim distal to the floor, wherein at least the rim and the wall have a plurality of grooves therein which extend from the rim towards the floor on the inside of the container;

b) positioning a thermoformable film above the rim of the container, said film having sufficient melt strength to be conformable to the inside of the container and to the food;

c) heating said film;

d) lowering said film onto said container and providing a reduced pressure outside said container such that the vacuum pressure sucks air through the grooves to pull said film into conformity with the food and at least the inside walls of the container, and the film then seals the container;

e) permitting the film to cool; and

f) removing the lidded container.

In a preferred embodiment the process is carried out using a conventional "skin packaging" machine.

In a preferred embodiment the film is made from a polymer selected from amorphous polyester, partially crystalline polyester and mixtures thereof; amorphous polyester, partially crystalline polyester and mixtures thereof admixed with at least one

compatibilized polyolefin; and amorphous nylon and mixtures thereof with at least one compatibilized polyolefin, and is heated to a temperature of from 65 to 95°C in step c).

In one embodiment the grooves, at least at the rim and adjacent thereto, have a width of from 0.25 mm to about 1.5 mm and a depth of from about 0.25 mm.

In another embodiment the depth of the grooves is from 0.3 mm to about 0.5 mm, especially from 0.35 mm to 0.4 mm.

In a further embodiment the width of the grooves is from about 0.7 mm to 1.0 mm.

In a preferred embodiment each groove is 30 mm or less apart from an adjacent groove, preferably 6 mm apart or less, and especially 3 mm apart or less.

In another embodiment the rim is in the form of a lip, circumferentially attached to the wall and which extends outwards, parallel to the floor.

In a further embodiment the grooves extend to the outside of the container, at least part-way down the outside of the wall.

In yet another embodiment the grooves extend to the outside of the container, at least part-way down the outside of the wall and such exterior grooves are offset from the grooves on the inside of the container.

In yet another embodiment the grooves on the inside of the container are in the form of letters or other design elements.

In another embodiment the lips of at least some of the grooves are raised above the surface of the surrounding container material.

In yet another embodiment the container is injection moulded, preferably from nylon or polypropylene.

In a further embodiment the container is made from a thermosetting resin.

Another aspect of the invention provides a food package comprising food contained in the aforementioned container, said container and food being covered with a lid comprising a film which substantially conforms to the exposed food and interior of the food-containing container.

Provided that the container has sufficient rigidity to withstand forces engendered in the process for making the conformed lid, the container may be made from any suitable materia. For example, for prepackaged food intended for conventional oven cooking, the container may be made of aluminium, CPET or nylon, amongst other materials. For microwave cooking, CPET, ABS and nylon, amongst other materials are suitable. Particularly suitable materials are disclosed in European Patent Application 0 231 663 published 1987 August 12, to D.H. Dawes and E.L. Fletcher.

The lid may be made from films such as polyethylene, ionomer, amorphous polyethylene terephthalate, case, i.e. substantially unoriented, nylon, films. The film may also be in the form of a laminate or coextrusion. The film is preferably from 25 to 250 µm in thickness and, more preferably, from 50 to 105 µm.

The term "compatibilized polyolefin" refers to olefin-based polymers having polar groups attached thereto which allow the olefin-based polymer and the nylon or polyester to be blended without phase separation. Such compatibilized olefin-based polymers may be in the form of so-called graft copolymers. The compatibilized olefin-based polymers may also be mixtures of compatibilized olefin-based polymers and olefin-based polymers which are incompatible with the nylon or polyester. Examples of such incompatible polymers include homopolymers of ethylene or propylene, copolymers of ethylene and C_4 to C_{10} alpha-olefins, polyisobutylene and poly(4-methylpentene-1). Examples of compatibilized olefin-based polymers include copolymers of ethylene and an unsaturated carboxylic acid or copolymers of ethylene and an unsaturated carboxylic acid ester monomer, e.g. ethylene/vinyl acetate copolymers, ethylene/methylacrylate copolymers, ethylene/ethylacrylate copolymers, ethylene/n-butylacrylate copolymers, ethylene/methacrylate copolymers, ethylene/methacrylic acid copolymer and partially neutralized ethylene/methacrylic acid copolymers (ionomers); hydrocarbon alpha-olefins grafted with an unsaturated carboxylic acids or hydrocarbon alpha-olefins grafted with an unsaturated anhydride, e.g. ethylene/acrylate ester copolymer grafted with an unsaturated carboxylic acid or unsaturated anhydride, ethylene/C_4 to C_{10} alpha-olefin copolymers grafted with unsaturated carboxylic acids or ethylene/C_4 to C_{10} alpha-olefin copolymers grafted with an unsaturated anhydride, ethylene homopolymers grafted with an unsaturated carboxylic acid and ethylene homopolymers grafted with an unsaturated anhydride. The preferred unsaturated carboxylic acid and unsaturated anhydride are maleic acid and maleic anhydride. Such compatibilized polyolefin materials must, of course, be compatible with the polyesters, e.g. polyethylene terephthalates, or nylons useful in this invention.

Suitable apparatus for carrying out the process of the present invention is available from a number of commercial suppliers. One such apparatus is manufactured by Allied Automation Inc. of Texas, U.S.A.

With such apparatus, the film, which is to be used for the lid, is pulled from a roll and held in a frame. The frame is larger than the plan-form of the container which is to be lidded. The framed film is heated from about with, for example, hot wire heating elements or infra-red lamps. The film tends to soften and sag slightly when the film is hot enough for the next step int he process. The frame, with film, is caused to descend onto a container which is filled with food and which is positioned on a platen having holes therein. The heating is then stopped and vacuum is applied from beneath the platen. The heat-softened film is pulled downwards, around the lip of the container. Additionally the vacuum is such that, because of the presence of the grooves in the container, it is able to suck air from below the film in the container thereby pulling the film into conformity with the food within the container and into conformity with the walls and rim of the container. The container is sealed by the film then conforming to a smooth surface of the container and/or conforming to and blocking the grooves. In cases when the container has an externally extending lip, at the rim

of the container, the film is sucked closely into contact with the upper and lower surface of the lip. The vacuum is then released, the frame is permitted to release the film and the thus-lidded container is transported away from the platen. Any excess film may then be trimmed, and the frame grasps more film so that the next cycle of the process may take place. Some of the excess film may be left in place, to act as a pull-tab for removal of the lid.

It is important that the grooves are not too shallow in relation to the width of the grooves; otherwise the firm is likely to block the groove when it is first drawn into conformity with the container. Such blockage is likely to prevent the film from conforming with the food. For reasons of structural strength, in general the grooves should not have a depth of more than about half of the wall thickness. For example, for nylon containers having a wall thickness of about 0.76 mm, the grooves in the containers should be less than about 0.40 mm. In any event, in terms of operational efficiency, there is less and less benefit to having deeper grooves. With respect to width of the grooves it has been found that with lidding films of 54 μm in thickness, made from a blend of a partially crystalline polyester and a compatibilized polyolefin, the grooves should not be wider than about 1.5 mm and preferably be between about 0.5 and 0.75 mm in width. It is preferable, also, that the grooves extend from the inside of the container to the outside, e.g. down the outside walls of the container, as the process causes film to be drawn over the outside of the container walls. Although not necessary, it is preferable for the grooves to extend to the centre of the floor of the container. This permits faster evacuation of the air fromthe container. Although it is preferable that the grooves extend radially across the floor of the container and up the walls, in straight lines, it is not necessary that they do so. For example, the grooves may form a pattern e.g. arcuate, sinusoidal, provided that there is a route along which air may travel from the container during the lidding process. The pattern may be regular, as for example in a star burst pattern, or may be irregular, as for example in letters or cursive writing. The cross-sectional shape of the grooves is unimportant and may be, for example U-shaped or V-shaped. Furthermore, it is not necessary that the cross-sectional area of the groove remain the same along the length of the groove, e.g. it may taper.

It has been found that the larger the number of grooves the faster is the lidding process. For example, with a tray about 19.5 cm in diameter and about 18 mm deep, having only four grooves, each about 1.25 mm wide and 0.25 mm deep, the process was very slow and it was difficult to ensure that the film was in conformity with the food. A similar result was obtained with four grooves, about 0.75 mm wide and 0.25 mm deep. With twenty grooves of similar dimensions, at about 6 mm spacings on a 20 cm diameter tray, the process was quick.

The shape of the container may vary considerably, although it will normally be of such a shape as can be used for serving food. It is normal to have the container in a tray shape. In plan-form it may be circular, oval, rectangular or kidney-shaped. The container may also be compartmentalized so that different types of food, e.g. meat, potatoes, vegetables, may be kept separated.

As indicated hereinbefore the lips of the grooves may be raised above the surface of the surrounding material of the container. This may be accomplished by having raised areas on the container surface, e.g. raised strips, which have the grooves formed or cut therein. It is preferable that the raised strips join smoothly with the surrounding material. Raised strips with grooves therein are particularly useful when the container thickness would not, by itself, permit use of sufficiently deep grooves for the lidding process to occur quickly and efficiently, without compromising the structural integrity of the container. The raised portions would provide the extra thickness to strengthen the container at the grooved portion and thus provide such structural integrity. The raised areas would normally be no more than about 1 mm above the surrounding container material.

Claims

1. A container made of a substantially gas impermeable material, said container comprising a floor, a circumferential wall attached to said floor, and a rim distal to the floor, wherein at least the rim and the wall have a plurality of grooves therein which extend on the inside of the container from the rim towards the floor.

2. A container according to claim 1 wherein adjacent grooves are 30 mm or less apart.

3. A container according to claim 2 wherein adjacent grooves are 6 mm apart or less.

4. A container according to any one of claims 1 to 3 wherein each groove, at least at the rim and adjacent thereto, has a width of from 0.25 mm to about 1.5 mm and a depth of at least 0.25 mm.

5. A container according to any one of the preceding claims wherein the rim is in the form of a lip, circumferentially attached to the wall and which extends outwardly and parallel to the floor.

6. A container according to any one of the preceding claims wherein the grooves extend to the outside of the container, part-way down the wall.

7. A container according to any one of the preceding claims wherein the container is made of polypropylene or Nylon.

8. A container according to any of the preceding claims which is injection moulded.

9. A food package comprising food contained in a container as claimed in any one of the preceding claims, the container and food being covered with a lid comprising a film which substantially conforms with the interior of the food-containing container.

10. A food package according to claim 9 wherein the thermoformable film is a film made from an amorphous polyester, a partially cry-

stalline polyester or a mixture thereof; amorphous polyester, partially crystalline polyester or a mixture thereof admixed with at least one compatibilized polyolefin; and an amorphous nylon or a mixture thereof with at least one compatibilized polyolefin.

11. A method for packaging food, comprising the steps of:

a) placing food in a container as claimed in any one of claims 1 to 8;

b) positioning a thermoformable film above the rim of the container, said film having sufficient melt strength to be conformable to the inside of the container and food;

c) heating said film;

d) lowering said film onto said container and providing a reduced pressure outside said container such that the vacuum sucks air through said grooves to pull said film into conformity with the food and at least the inside walls of the container, and the film then seals the container;

e) permitting the film to cool; and

f) removing the lidded container.

12. A method according to claim 11 wherein the thermoformable film is a film made from an amorphous polyester, partially crystalline polyester or a mixture thereof; amorphous polyester, partially crystalline polyester or a mixture thereof admixed with at least one compatibilized polyolefin; and amorphous nylon or a mixture thereof with at least one compatibilized polyolefin, and the film is heated to a temperature of from 65 to 95° C in step c).